

Copyright © 1985  
by the  
AMERICAN SOCIETY FOR METALS  
All rights reserved

First printing, November 1984  
Second printing, May 1985  
Third printing, June 1986  
Fourth printing, October 1988  
Fifth printing, October 1989  
Sixth printing, May 1991  
Seventh printing, September 1992  
Eighth printing, May 1995

No part of this book may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the written permission of the copyright owner.

Metals Handbook is a collective effort involving thousands of technical specialists. It brings together in one book a wealth of information from world-wide sources to help scientists, engineers, and technicians solve current and long-range problems.

Great care is taken in the compilation and production of this volume, but it should be made clear that no warranties, express or implied, are given in connection with the accuracy or completeness of this publication, and no responsibility can be taken for any claims that may arise.

Nothing contained in the Metals Handbook shall be construed as a grant of any right of manufacture, sale, use, or reproduction, in connection with any method, process, apparatus, product, composition, or system, whether or not covered by letters patent, copyright, or trademark, and nothing contained in the Metals Handbook shall be construed as a defense against any alleged infringement of letters patent, copyright, or trademark, or as a defense against any liability for such infringement.

Comments, criticisms, and suggestions are invited, and should be forwarded to the American Society for Metals, Metals Park, Ohio 44073.

Library of Congress Catalog Card Number: 84-71465  
ISBN: 0-87170-188-X  
SAN: 204-7586

Project Director: Timothy L. Gall  
ASM Staff Assistants: Joan L. Tomsic and Judith S. Gibbs  
Editorial and production coordination by Carnes Publication Services, Inc.  
President: William J. Carnes  
Project Manager: Craig W. Kirkpatrick

PRINTED IN THE UNITED STATES OF AMERICA